MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
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Gaithersburg, Maryland 20899-2321

SRM Number: 2659a
MSDS Number: 2659a
SRM Name: Oxygen in Nitrogen

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SECTION I. MATERIAL IDENTIFICATION

Material Name: Oxygen in Nitrogen

Description: This SRM mixture is supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a water volume of 6 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psi) which provides the user with 0.73 m^3 (25.8 ft^3) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-590 brass valve, which is the recommended outlet for this carbon monoxide mixture. NIST recommends that this cylinder not be used below 0.7 MPa (100 psi).

Other Designations: Oxygen (dioxygen; molecular oxygen) in **Nitrogen** (dinitrogen) **Gas Cylinder**

Chemical Name	Chemical Formula	CAS Registry Number
Oxygen	O_2	7782-44-7
Nitrogen	N_2	7727-37-9

DOT Classification: Non-flammable Gas, UN1956

Manufacturer/Supplier: Available from a number of suppliers

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration	Exposure Limits and Toxicity Data
Oxygen	21 % mol/mol	No occupational exposure limits established
		Rat, Inhalation: TC_{LO}: 95 g/kg/24 hrs/2 days
		Human, Inhalation: TC_{LO}: 100 g/kg/24 h/3 days
Nitrogen	balance	simple asphyxiant
		Rat, Inhalation: LC_{50}: 1068 mg/m^3/4 h
		Mouse, Inhalation: LC_{LO}: 320 mg/kg

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitrogen	Oxygen
Appearance and Odor: colorless and odorless	**Appearance and Odor:** colorless and odorless
Relative Molecular Mass: 28.0134	**Relative Molecular Mass:** 31.99
Density: 1.2506 g/L	**Density:** 1.309 g/L
Vapor Density (air = 1): 0.967	**Vapor Density (air = 1):** 1.1
Vapor Pressure (-196 °C): 760 mm Hg	**Vapor Pressure (-183 °C):** 760 mm Hg
Freezing Point: -210 °C	**Freezing Point:** -218 °C
Boiling Point: -196 °C	**Boiling Point:** -183 °C
Viscosity (@ 27 °C): 0.01787 cP	**Viscosity (@ 25 °C):** 0.02075 cP
Water Solubility: 1.6 %	**Water Solubility**: 3.2 %
Solvent Solubility: soluble in liquid ammonia; slightly soluble in alcohol	**Solvent Solubility:** soluble in alcohol

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this oxygen/nitrogen mixture do not exist. The actual behavior of the mixture may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: Nonflammable **Autoignition Temperature:** Not Appplicable

Flammability Limits in Air (Volume %): **UPPER:** Not Applicable
LOWER: Not Applicable

Unusual Fire and Explosion Hazards: Nitrogen is a negligible fire hazard. Cylinders may rupture under fire conditions. Nitrogen reacts with lithium, magnesium, neodymium at high temperatures. Mixtures of ozone and nitrogen may be explosive. Titanium is the only element that will burn in nitrogen.

Oxygen is a negligible fire hazard. It is however, an oxidizer and may ignite or explode on contact with combustible materials. Containers may rupture or explode of exposed to heat.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Fire fighters should wear full protective clothing and self-contained breathing apparatus (SCBA) when this material is involved in a fire. Keep fire cylinders cool with water spray. If possible, stop the product flow.

SECTION V. REACTIVITY DATA

Stability: **X** **Stable** ____ **Unstable**

Conditions to Avoid: Protect cylinders from physical damage and sources of heat. **DO NOT** store cylinder in poorly ventilated areas.

Incompatibility (Materials to Avoid): Nitrogen is incompatible with metals and oxidizing materials.

Oxygen is incompatible with combustible materials, halo carbons, metals, bases, reducing agents, amines, metal salts, and oxidizing materials.

See Section IV: *Fire and Explosion Hazard Data*

Hazardous Decomposition or Byproducts: Thermal decomposition of nitrogen will produce oxides of nitrogen. Thermal decomposition products of oxygen will yield miscellaneous decomposition products.

Hazardous Polymerization: _____ **Will Occur** **X** **Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: **X** **Inhalation** **X** **Skin** ____ **Ingestion**

Nitrogen: This material is a high pressure gas that can cause rapid suffocation. This gas may also cause eye, skin, and respiratory tract burns. The mixture can act as a simple asphyxiant by displacing air necessary for life. Nitrogen inhaled under increased atmospheric pressure, (>1.5 atmospheres), may dissolve in the fat-containing brain cells, and act as an anesthetic, causing necrosis. Persons who have been exposed to nitrogen under increased pressure and then suddenly released from the pressure may develop decompression sickness. Decompression is sickness caused by the formation of nitrogen bubbles in the blood following a rapid drop in pressure and is characterized by severe pains in the joints and chest, skin irritation, cramps, and paralysis.

Oxygen: Pure oxygen, especially if not properly humidified, may cause mucous membrane irritation and pulmonary edema after a period of 24 hours. Air normally contains 20 % to 21% oxygen. As exposure to higher concentrations and/or greater the atmospheric pressure continues, symptoms of toxicity may develop and increase in severity. Respiratory system effects may include a progressive decrease in vital capacity, tightness in the chest and discomfort, coughing, congestion, pneumonia, edema, and rapid panting. Cardiovascular system effects may include bradycardia, hyperthermia and peripheral vasoconstriction. The nervous system may also be affected with nausea, dizziness, parethesias including tingling of the fingers and toes, muscular twitching, and visual and auditory hallucinations. At increased atmospheric pressures, vision may be affected. Animal studies indicate exposure to oxygen under high pressure has caused hemolytic anemia. In pregnant women exposed to 100 % oxygen for 20 minutes, the response was a fetal cardiac rate which decreased and became variable. Toxic action is greatly enhanced by exercise or by the presence of moderate amounts of carbon dioxide.

Inhalation of pure oxygen for periods of up to 16 hours per day for an extended period at atmospheric pressure has caused no observed injury to humans.

Medical Conditions Generally Aggravated by Exposure: Nitrogen: respiratory disorders

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens		X
In the International Agency for Research on Cancer (IARC) Monographs		X
By the Occupational Safety and Health Administration (OSHA)		X

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with copious amounts of water for at least 15 minutes while removing contaminated clothing. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance if necessary.

Inhalation: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. Lay victim with head and chest lower than hips to improve drainage of fluids from the lungs. Obtain medical assistance.

Ingestion: Not Applicable

TARGET ORGAN(S) OF ATTACK: Not Available

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released: Evacuate and ventilate area. Remove leaking cylinder to exhaust hood or safe outdoor area. Shut off source if possible and remove source of heat. In case of leakage, use SCBA.

Waste Disposal: Dispose of gas into an adequate amount of alkaline potassium permanganate solution. Dispose of non-refillable cylinders in accordance with federal, state, and local regulations. **DO NOT** return the empty cylinder to the supplier.

Handling and Storage: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders. Wear safety shoes when handling cylinders. Use adequate general and local exhaust ventilation to maintain concentrations below exposure limits and to avoid asphyxiation. A chemical safety shower and an eyewash station must be readily available. For protection of eyes, wear safety glasses.

> **NOTE:** Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store in well ventilated areas away from combustibles. Keep valve protection cap on cylinders when not in use.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Source: MDL Information Systems, Inc., MSDS *Nitrogen, Compressed Gas*, 16 September 2002.
MDL Information Systems, Inc., MSDS *Oxygen, Compressed Gas*, 11 December 2001.